POSTAL BOOK PACKAGE 2027

CIVIL ENGINEERING

OBJECTIVE PRACTICE SETS VOLUME - I

CONTENTS

CONSTRUCTION PRACTICE, PLANNING AND MANAGEMENT

OBJECTIVE PRACTICE SETS

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1 CHAPTER
Construction Practice, Planning and Management

Q.1 Which of the following is not a disadvantage of bar chart?
(a) Suitable only for small job.
(b) Cost control cannot be achieved.
(c) Optimum use of men and machines cannot be done.
(d) None of these

Q.2 Preliminary project report for a road project must contain
(a) the detailed estimated cost based on detailed design
(b) the several alternatives of the project that have been considered
(c) the soil survey, traffic survey, concept design and approximate cost
(d) the contract documents for inviting tenders

Q.3 A serious limitation of interdependencies between various activities is generally observed in
(a) bar charts (b) milestone charts
(c) network analysis (d) job layouts

Q.4 Consider the following statements:
1. Pre–qualification of tenders is not required in case of bigger and complex project.
2. The project promoter is not liable to make any payment to the sub–contractor.

Which of the above statements is(are) CORRECT?
(a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

Q.5 Match **List-I** (Indications of terms) with **List-II** (Terms) and select the correct answer using the codes given below the lists:

List-I
A. Used for recording instructions given by the Executive Engineer at site
B. Used widely for civil engineering construction
C. One of the principles of organizations
D. One of the functions of management

List-II
1. Coordination
2. Unity of command
3. Line organization
4. Site order book

Codes:

	A	B	C	D
(a)	4	3	2	1
(b)	4	2	3	1
(c)	1	4	1	3
(d)	4	1	2	3

Directions : Each of the next items consists of two statements, one labelled as 'Statement (I)' and the other as 'Statement (II)'. Examine these two statements carefully and select the answers to these items using the codes given below:

Codes:
(a) Both Statement (I) and Statement (II) are individually true; and Statement (II) is the correct explanation of Statement (I)
(b) Both Statement (I) and Statement (II) are individually true; but Statement (II) is NOT the correct explanation of Statement (I)
(c) Statement (I) is true; but Statement (II) is false
(d) Statement (I) is false; but Statement (II) is true

Q.6 **Statement (I):** Interdependence between various events is shown on a milestone chart.
Statement (II): Milestones are key events in time which occur as the project progresses.

Q.7 Consider the following statements regarding Tenders:
1. Tender notice contains documents regarding cost of project, drawings of project, time of completion etc.
2. Security money is deposited by all the bidders.

Which of the above statement(s) is(are) CORRECT?

(a) 1 only (b) 2 only
(c) Both 1 and 2 (d) None of the above

Q.8 Consider the following statements regarding contract:

1. It is an agreement.
2. This agreement must be enforceable by law.
3. 'Liquidated damages' is a clause which ensures the completion of project as per original schedule.

Which of the above statement(s) is(are) CORRECT?

(a) 1 and 2 (b) 2 and 3
(c) 1 only (d) 1, 2 and 3

Q.9 Consider the following statements regarding Gantt Chart.

1. It gives comparison of actual progress with scheduled progress.
2. It gives idea about physical progress of project.
3. It also gives idea about financial aspect.

Which of the above statements are CORRECT?

(a) 1 and 2 (b) 2 and 3
(c) 1 and 3 (d) 1, 2 and 3

Q.10 Consider the following statements about work-break down structure (WBS):

1. In WBS, top down approach is adopted.
2. Facilitates and improve the decision making for procurement of resources.
3. Coordinates regarding milestone events across trade specializations to improve the synergy between the trade.

Which of the above statements are CORRECT?

(a) 1 and 2 (b) 2 and 3
(c) 1 and 3 (d) 1, 2 and 3

Q.11 Consider the following statements:

1. A bar chart does not show the progress of work and hence it cannot be used as a control device.
2. Network diagram can be used even for highly complicated projects consisting of a large number of activities.

Which of the above statements is(are) INCORRECT?

(a) Both 1 and 2 (b) 1 only
(c) 2 only (d) Neither 1 nor 2

Q.12 Consider the following statements in the bar chart planning

1. interdependence of the operations cannot be portrayed
2. progress of work can be measured
3. spare time of the activities can be determined
4. schedule cannot be updated.

Which of these statements are correct?

(a) 1, 2 and 3 (b) 1 and 4
(c) 2, 3 and 4 (d) 1, 2 and 4

Multiple Select Questions (MSQ)

Q.13 Which of the following statement(s) are essential conditions of contracts?

(a) Competent parties
(b) Discrete subject matter
(c) Free consent
(d) Must not be declared void by the law in force.

Q.14 Consider the following statements regarding types of construction contracts and mark the correct options.

(a) In cost plus percentage of cost contract, customer is at most risk of absorbing excessive cost overruns.
(b) In firm-fixed price contract, contractor is most likely to control costs.
(c) In firm fixed price with economic adjustments contract, the contractor is given relief for inflation.
(d) Fixed price contract requires maximum follow up on work.

■■■■

Answers Construction, Planning and Management

1. (d) 2. (c) 3. (a) 4. (b) 5. (a) 6. (a) 7. (a) 8. (d) 9. (a) 10. (d)
11. (d) 12. (a) 13. (a, c, d) 14. (a, b, c)

Explanations Construction, Planning and Management

2. (c)
Preliminary project report contains topographic details and soil survey along alternate alignments, consideration of geometric design and other requirements of alignment, preparation of plans and comparison of alternate routes, economic analysis and selection of final alignment.

3. (a)
In bar charts, inter-dependence between various activities is not shown.

4. (b)
Prequalification is a means of identifying contractors who indicate that they are qualified and would be interested is tendering for a potential project. Prequalification is primarily applied for large, complex projects that require specialised technical expertise.

6. (a)
About Milestone chart
1. Modification over bar and linked bar chart
2. Milstone are key event, which refers to the particular instant of time that occurs as project progress.
3. Inter dependencies between the events can be shown on a milestone chart
4. Uncertainity cannot be predicted in milestone chart.

7. (a)
Security money is deposited by successful bidder only.

8. (d)
- A contract is a mutual or legally binding agreement between two parties based policies and conditions recorded in document form.
- A construction contract is an important piece of document that outlines the scope of work, risks, duties and legal rights of both the contractor and the owner.

9. (a)
About Gantt chart
1. In Gantt chart, activity independent of each other.
2. Sequence of activity is not defined.
3. No concept of cost optiminisation, No idea about financial aspects
4. No concept of critical activity.

12. (a)
About bar chart planning
1. Here, the activities or operations are independent of each other
2. Sequence of activity is not defined
3. Difficulty in judgement, whether activity is completed or not
4. No concept of cost optimisation
5. Schedule cannot be updated
6. Length of the bar shows the time required for the completion
7. Resource requirement can be depicted.

13. (a, c, d)
Contracts should have lawful subject matter.

■■■■

STRUCTURAL ANALYSIS

OBJECTIVE PRACTICE SETS

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1 CHAPTER
Determinacy and Indeterminacy

Q.1 The number of degrees of freedom of a point in space is
(a) 3 (b) 6
(c) 9 (d) unlimited number

Q.2 The minimum number of overall equilibrium equations for plane truss analysis must be equal to
(a) 2 (b) 3
(c) 6 (d) unlimited number

Q.3 The number of compatibility conditions needed in the analysis of a statically determinate structure are
(a) 0 (b) 2
(c) 3 (d) 6

Q.4 Compatibility conditions are primarily governed by
(a) strains (b) stresses
(c) temperature (d) forces

Q.5 Geometrically unstable structures can be used in
(a) pin-connected systems
(b) temporary systems
(c) long spans
(d) earthquake zones

Q.6 If there are m unknown member forces, r unknown reaction components and j number of joints, then the degree of static indeterminacy of a pin-joined plane frame is given by
(a) $m + r + 2j$ (b) $m - r + 2j$
(c) $m + r - 2j$ (d) $m + r - 3j$

Q.7 A pin-jointed plane frame is unstable if
(a) $(m + r) < 2j$ (b) $m + r = 2j$
(c) $(m + r) > 2j$ (d) none of these
where m is number of members, r is reaction components and j is number of joints

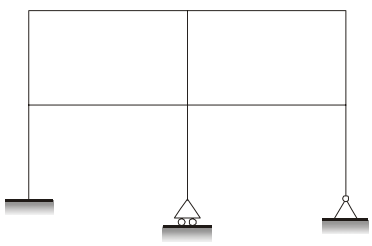
Q.8 A rigid-jointed plane frame is stable and statically determinate if
(a) $(m + r) = 2j$ (b) $(m + r) = 3j$
(c) $(3m + r) = 3j$ (d) $(m + 3r) = 3j$
(c) 1 and 4 (d) 2 and 4

Q.9 An statically indeterminate building frame may be converted to a statically determinate one by assuming
(a) hinges at mid-height of columns
(b) hinges at the mid-span of the beams
(c) hinges at both mid-height of columns and mid-span of beams
(d) one support as fixed at base and other support on rollers

Q.10 Consider the following statements:
1. An statically indeterminate structure is not economical from the material stand-point in comparison to a statically determinate structure.
2. If 'n' redundants in a statically indeterminate structure of 'n' degree of static indeterminacy are removed, the structure will become statically determinate but unstable.
3. In the rigid frame analysis, the axial effects are ignored as their influence is negligibly small compared to bending and shear effects.

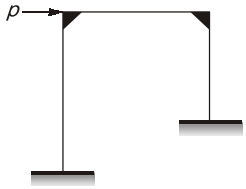
Which of these statements is/are correct?
(a) 1 only (b) 1 and 2
(c) 3 only (d) 2 and 3

Q.11 What is the kinematic indeterminacy for the frame shown below? (Members are in extensible)



(a) 6 (b) 11
(c) 12 (d) 21

Q.12



The portal frame shown in the above figure is statically indeterminate to the
(a) first degree (b) second degree
(c) third degree (d) None of the above

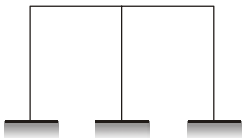
Q.13 Match **List-I** (Structure) with **List-II** (Degree of static indeterminacy) and select the correct answer using the codes given below the lists:

List-I

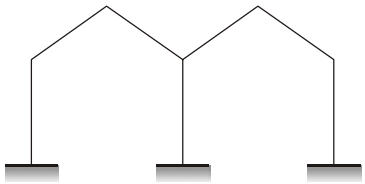
A.

B.

C.



D.



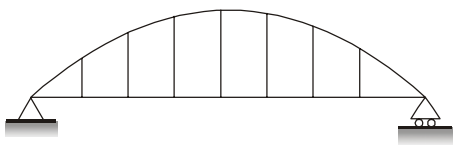
List-II

1. Three
2. Six
3. Two
4. Four

Codes:

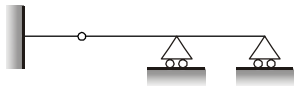
	A	B	C	D
(a)	1	3	2	2
(b)	3	1	2	4
(c)	3	1	4	2
(d)	1	3	4	2

Q.14 The static indeterminacy of the rigid frame shown is



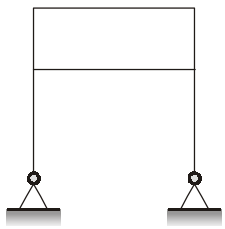
(a) 21 (b) 23
(c) 24 (d) 19

Q.15 The degree of indeterminacy of the beam given below is



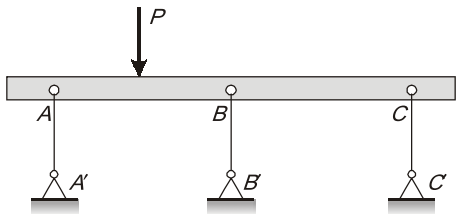
(a) zero (b) one
(c) two (d) three

Q.16 What is the degree of Kinematic indeterminacy of the frame shown in figure? Neglect axial deformation.



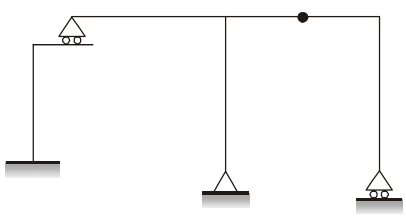
(a) 14 (b) 12
(c) 10 (d) 8

Q.17 The beam supported by 3 links and loaded as shown in the figure is



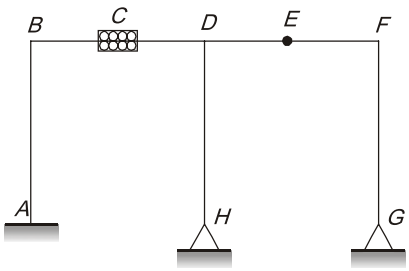
(a) stable and determinate
(b) unstable
(c) stable and indeterminate
(d) unstable but determinate

Q.18 A plane structure shown in the figure is



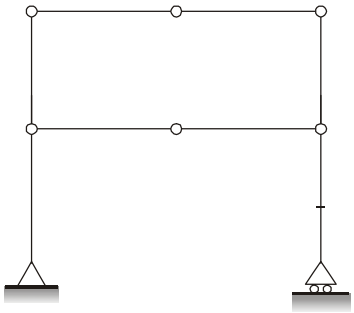
(a) stable and determinate
(b) stable and indeterminate
(c) unstable and determinate
(d) unstable and indeterminate

Q.19 A plane frame *ABCDEFGH* shown in figure has a clamp support at *A*, hinge supports at *G* and *H*, axial force release at *C* and moment release (hinge) at *E*. The static (d_s) and kinematic (d_k) indeterminacies respectively are



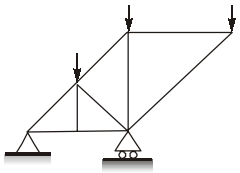
(a) 4, 9 (b) 3, 11
(c) 2, 12 (d) 1, 14

Q.20 The plane pin-jointed structure shown in figure below is



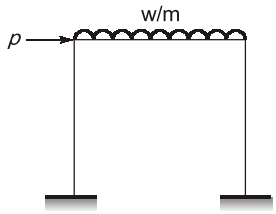
(a) externally indeterminate
(b) internally indeterminate
(c) determinate
(d) mechanism

Q.21 The pin-jointed frame shown in the figure is:



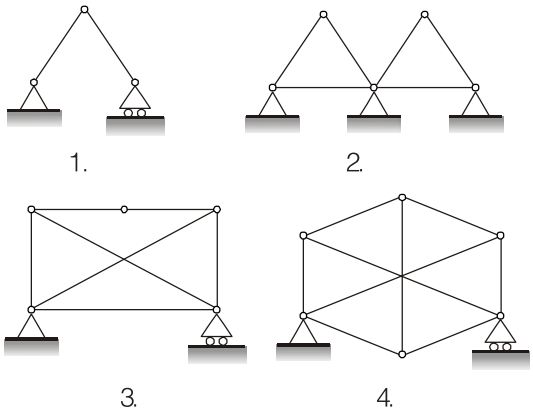
(a) a perfect frame
(b) a redundant frame
(c) a deficient frame
(d) None of the above

Q.22 The frame shown in the given figure has



(a) one unknown reaction component
(b) two unknown reaction components
(c) three unknown reaction components
(d) six unknown reaction components

Q.23 Consider the following pin-jointed plane frames



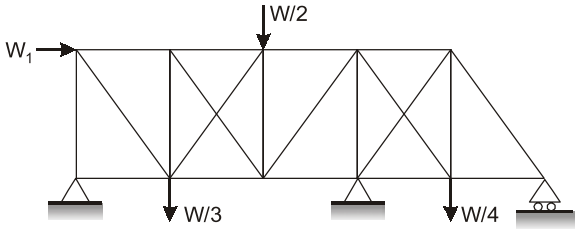
Which of these frames are stable?
(a) 1, 2 and 3 (b) both 3 and 4
(c) 2, 3 and 4 (d) both 2 and 4

Q.24 A prismatic beam is shown in the figure given below.

Consider the following statements:
1. The structure is unstable.
2. The bending moment is zero at supports and internal hinge.
3. It is a mechanism.
4. It is statically indeterminate.

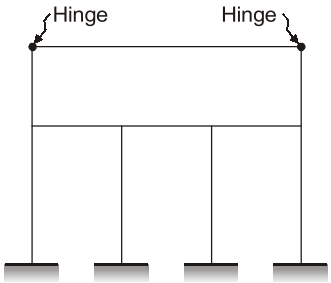
Which of these statements are correct?
(a) 1, 2, 3 and 4 (b) 1, 2 and 3
(c) 1 and 2 (d) 3 and 4

Q.25 The degree of static indeterminacy of the pin-jointed plane frame as shown in figure is



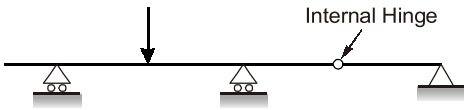
(a) 1 (b) 2
(c) 3 (d) 4

Q.26 What is the total degree of indeterminacy both internal and external of the plane frame shown below?

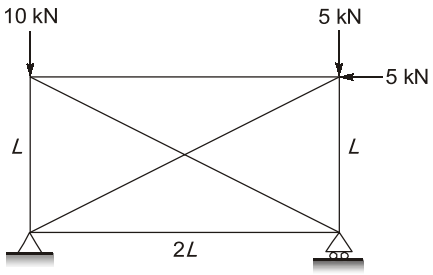


(a) 10 (b) 11
(c) 12 (d) 14

Q.27 The static indeterminacy of the two-span continuous beam with an internal hinge, shown below, is _____.

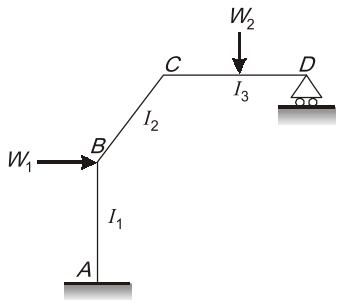


Q.28 The frame shown below is redundant to:



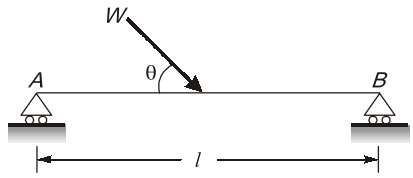
(a) single degree (b) two degree
(c) three degree (d) four degree

Q.29 The rigid plane frame *ABCD* has to be analyzed by slope deflection method. What is the number of unknown displacements/rotations for the frame as shown in the figure given below?



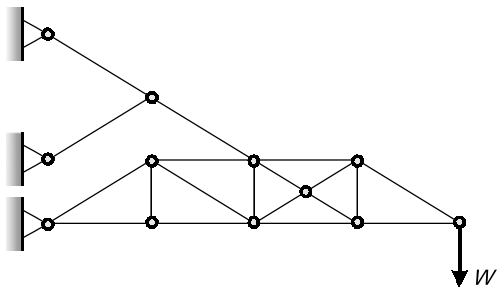
(a) 4 (b) 3
(c) 5 (d) 2

Q.30 The simply supported beam shown in the figure



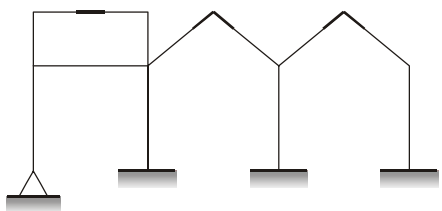
is
(a) determinate and stable
(b) determinate and unstable
(c) indeterminate and stable
(d) indeterminate and unstable

Q.31 The total (both external and internal) degrees of indeterminacy of the pin-jointed structure shown in the figure is



(a) 4 (b) 3
(c) 2 (d) 1

Q.32 The statical indeterminacy for the given 2*D* frame is



(a) 8 (b) 6
(c) 9 (d) 11

Answers Determinacy and Indeterminacy

1. (b)	2. (b)	3. (a)	4. (a)	5. (b)	6. (c)	7. (a)	8. (c)	9. (c)	10. (c)
11. (b)	12. (c)	13. (a)	14. (c)	15. (b)	16. (d)	17. (c)	18. (a)	19. (c)	20. (c)
21. (a)	22. (c)	23. (c)	24. (b)	25. (d)	26. (a)	27. 0	28. (a)	29. (c)	30. (b)
31. (d)	32. (d)	33. (a)	34. (a)	35. (b)	36. (b)	37. (d)	38. (c)	39. 15	40. (c)
41. (a)	42. (a)	43. (a)	44. (c)	45. (b)	46. (b)	47. (b)	48. (c)	49. (a, b, d)	
50. (b, c, d)		51. (c, d)		52. (a, b, d)		53. (a, b, c)			

Explanations Determinacy and Indeterminacy

1. (b)

Six degrees of freedom are

$$\Sigma F_x = 0, \Sigma F_y = 0, \Sigma F_z = 0 \text{ and,}$$
$$\Sigma M_x = \Sigma M_y = \Sigma M_z = 0$$

2. (b)

$$\Sigma F_x = 0, F_y = 0, M_z = 0$$

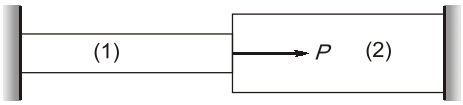
3. (a)

No. of compatibility equations needed
= Degree of static indeterminacy of structure (D_s)
As, $D_s = 0$ for a statically determinate structure
Hence, No. of compatibility equations needed = 0

4. (a)

Compatibility conditions are primary governed by strains. This is because compatibility equations are noting but the relations between the strains.

Example:



Here, the compatibility condition used will be,
Total Elongation = 0
i.e., Extension of (1) = Compression of (2)

and change in length $= \delta l = \dfrac{Pl}{AE}$

$\Rightarrow$ Strain $= \dfrac{\delta l}{l} = \dfrac{P}{AE}$

Hence, compatibility condition is governed by strain, which is turn is governed by stress.

5. (b)

Geometrically unstable structures cannot be used in any kind of permanent structures i.e., pin-connected systems, long spans or earthquake zones, as the movement of the structure will make it unsafe for use.

Hence, they can only be used in temporary systems which will be required for a limited period of time.

6. (c)

Static Indeterminacy (D_S) and Kinematic indeterminacy (D_k)

1. Pin jointed 2-D (plane) frame
   $\Rightarrow D_S = m + r - 2j$
   $D_k = 2j - r$
2. Pin jointed space frame (3-D)
   $D_S = m + r - 3j$
   $D_k = 3j - r$
3. Rigid jointed plane frame (2-D)
   $D_S = 3m + r - 3j - \Sigma(m' - 1)$
   $D_k = 3j - r - \Sigma(m' - 1)$
   $m' \rightarrow$ no. of members meeting at hybrid point.
4. Rigid jointed space frame (3-D)
   $D_S = 6m + r - 6j - \Sigma 3\,(m' - 1)$
   $D_k = 6j - r - \Sigma 3\,(m' - 1)$

7. (a)

For plane frame (pin jointed)
$m + r > 2j \rightarrow$ Indeterminate and over stiff
$m + r = 2j \rightarrow$ Stable and determinate
$m + r < 2j \rightarrow$ Unstable but determinate

8. (c)

For rigid jointed plane frame
$3m + R > 3j \rightarrow$ Indeterminate and over stiff

$3m + R = 3j \rightarrow$ Stable and determinate

$3m + R < 3j \rightarrow$ Unstable but determinate

9. (c)

There are two methods of approximate analysis:

(i) Portal method for low rise buildings.

(ii) Cantilever method for tall buildings.

Both methods assume an inflection point located at mid height of each column and an inflection point located at the centre of each beam.

10. (c)

An indeterminate structure develops less maximum bending moment over the span. So it requires less cross-section to resist and more economical from material stand point. It is not necessary that removal of n redundants result in unstable structure.

11. (b)

Degree of kinematic indeterminacy for a plane rigid frame having inextensible member is given by

$$D_k = 3j - r_e - m$$

where m = Total number of inextensible members

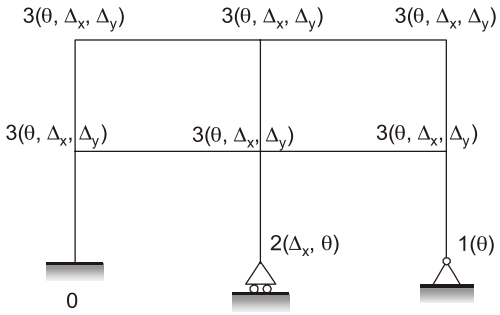
Here, $j = 9$

$r_e = 3 + 1 + 2 = 6$

$m = 10$

$\therefore \quad D_k = 3 \times 9 - 6 - 10 = 11$

Method-1:



For extensible members,

$D_k = 3 + 3 + 3 + 3 + 3 + 3 + 0 + 2 + 1$

$= 21$

Method-2:

Degree of kinematic indeterminacy for a plane rigid frame having extensible members is given by

$$D_k = 3j - r_e$$

Here, $j = 9$

$r_e = 3 \quad 1 + 2 = 6$

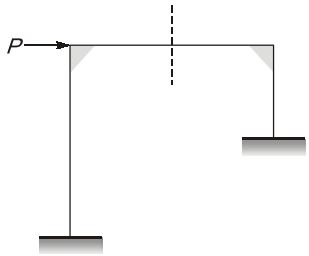
$\therefore \quad D_k = (3 \times 9) - 6 = 21$

12. (c)

Degree of static indeterminacy = $r_e - 3$

$= 6 - 3 = 3$

Alternate Solution :



D_s = 3 × no. of cuts – reactions added to make stable cantilevers

$= (3 \times 1) - 0$

$\Rightarrow \quad D_s = 3$

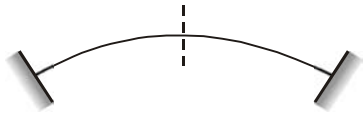
13. (a)

$D_s = (3 \times C) - 9$

Where C = no. of cuts

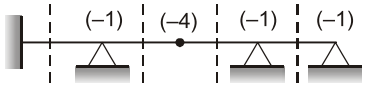
and n = reactions added to make stable cantilevers

A.



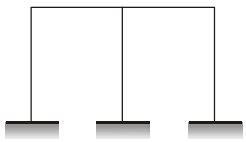
$D_s = (3 \times 1) - 0 = 3$

B.



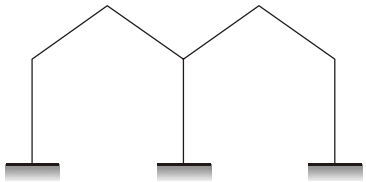
$D_s = (3 \times 3) - 1 - 4 - 1 - 1 = 2$

C.



$D_s = (3 \times 2) - 0 = 6$

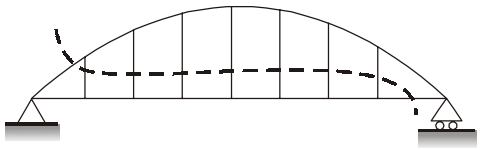
D.



$D_s = (3 \times 2) - 0 = 6$

Hence, option (a) is correct.

14. (c)



Number of cuts required to open the frame (C) = 9

Number of restraints required

$= 1 + 2 = 3$

$D_s = 3C - r_e$

$= 3 \times 9 - 3 = 24$

15. (b)

$D_S = r_e + 3m - r_r - 3(j + j')$

$r_e = 3 + 1 + 1 = 5$

$m = 3,\ j = 3,\ j' = 1$

The hinge will create 2 members.

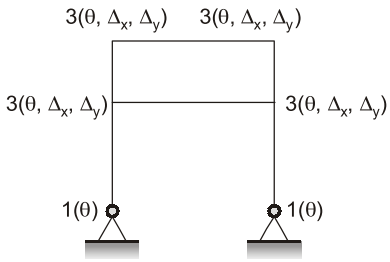
Number of internal reaction components released.

$r_r = 1.0$

$\therefore \quad D_s = 5 + 9 - 1.0 - 3 \times (3 + 1) = 1.0$

16. (d)

Method-1:



D_k = (inextensible) = D_k (extensible) – No. of axially rigid members

$\Rightarrow \quad D_k = (3 + 3 + 3 + 3 + 1 + 1) - 6$

$= 8$

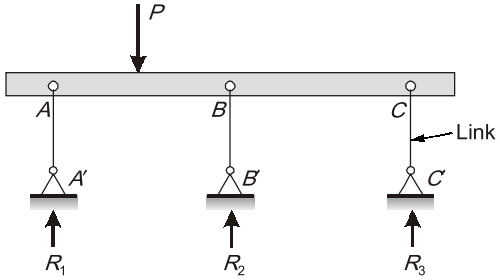
Method-2:

$D_k = 3j - m - r$

$= (3 \times 6) - 6 - (2 + 2)$

$= 8$

17. (c)



$D_{se} = 3 - 2 = 1$

$\rightarrow \Sigma F_y = 0$ & $\Sigma M = 0$

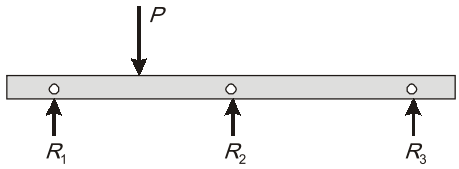
$D_{si} = 0$

$\therefore \quad D_s = 1$

(Indeterminate of degree 1)

Note : Link will carry only axial force (AA', BB', CC')

FBD:

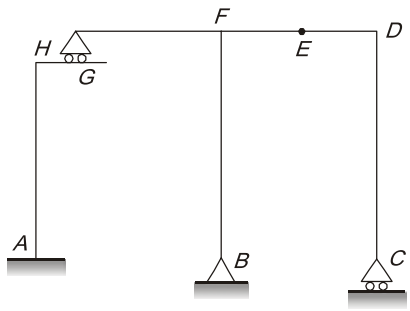


All reactions are parallel, but the structure is stable only for vertical loading.

Note : For general loading the structure is unstable.

18. (a)

Method-1: By formula



Static determinacy

$D_s = 3m + r_e - 3j - r_r$

$= (3 \times 7) + (3 + 2 + 1) - (3 \times 8)$

$- [1 \text{ (at } E) + 2 \text{ (at } G)]$

$= 0$

$\Rightarrow$ The structure is stable and determinate.

Method-II (By Cantilever Method)

$D_s = 3C - R$

Where 'R' is the number of release in a structure

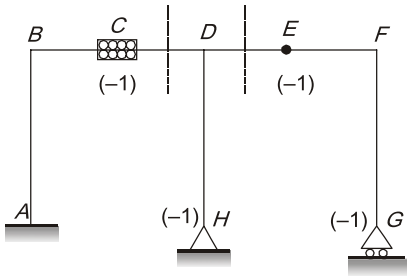
$= 3 \times 2 - [1 \text{ (at B)} + 2 \text{ (at C)}$

$+ 1 \text{ (ast E)} + 2 \text{ (at G)}]$

$= 0$

19. (c)

(i) D_s



Method-1:

D_s = (3 × no. of cuts) – No. of axially rigid members

= (3 × 2) – 1 – 1 – 1 – 1

= 2

Method-2:

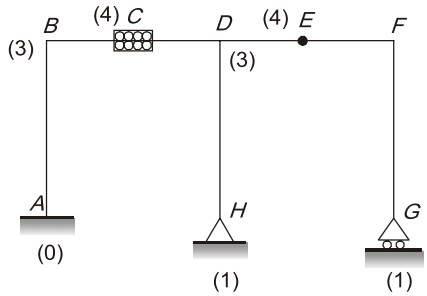
$D_s = 3m + r_e - 3j - \Sigma(m' - 1)$

Where m′ = member meeting at rigid joint

∴ D_s = 3 7 + 6 – 3 8 - 1

= 21 + 6 – 29 = 2

(ii) D_k



Method-1: By counting DOFs of joints

D_k = 3 + 4 + 4 + 3 + 1 + 1 + 3

= 19 (fro extensible members)

D_k (inextensible)

= D_k (extensible) – No. of axially rigid members

= 19 – 7 = 12

Hence, the correct option is (c)

20. (c)

$m + r = 8 + 3 = 11$ and $2j = 16$

∴ $m + r < 2j$

⇒ Unstable but determinate structure.

21. (a)

Degree of indeterminacy

$n = (m + r_e) - 2j,\ r_e = 3$

$= (9 + 3) - 2 \times 6 = 0$

Since the degree of indeterminacy is zero and the frame is stable so it is a perfect frame.

Key Points:

(i) If $m > 2j - 3$, truss is stable and internally indeterminate.

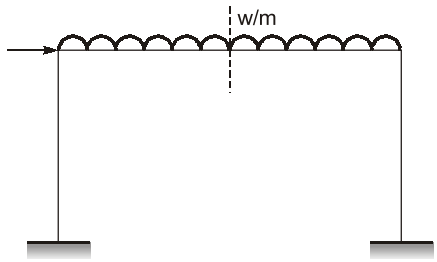
(ii) If $m < 2j - 3$, truss is internally unstable.

22. (c)

Degree of static indeterminacy

$= r_e - 3 = 6 - 3 = 3$

Alternate Solution:



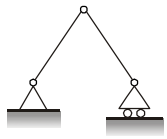
D_s = (3 × no. of cuts) – no. of reactions added to make stable cantilevers

= (3 × 1) – 0 = 0

As, $D_s = 3$

Hence, unknown reactions component are three.

23. (c)

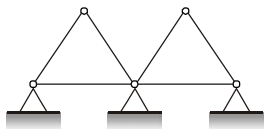
1. 

m + r = 2 + (2 + 1) = 5

and 2j = (2 × 3) = 6

∴ m + r < 2j

⇒ Unstable frame

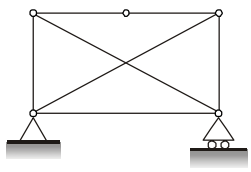
2. 

m + r = 6 + (2 + 2 + 2) = 12

and 2j = (2 × 5) = 10

∴ m + r > 2j

⇒ Stable frame

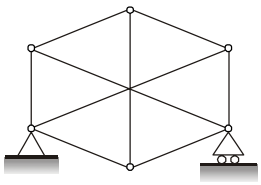
3. 

$m + r = 6 + (2 + 1) = 9$

and $2j = (2 \times 4) = 8$

$\therefore \quad m + r > 2j$

$\Rightarrow$ Stable frame

4. 

$m + r = 9 + (2 + 1) = 12$

and $2j = (2 \times 6) = 12$

$\therefore \quad m + r = 2j$

$\Rightarrow$ Stable frame

24. (b)

The degree of indeterminacy = 2 – 3 = –1

So the structure is deficient and unstable. It is a mechanism.

25. (d)

External indeterminacy,

$D_{se} = r_e - 3$

$r_e = 2 + 2 + 1 = 5$

$\therefore \quad D_{se} = r_e - 3 = 5 - 3 = 2$

Internal indeterminacy

$D_{si} = m - (2j - 3)$

No. of members, $m = 21$

Number of joints, $j = 11$

$\therefore \quad D_{si} = 21 - (2 \times 11 - 3)$

$= 21 - 19 = 2$

$\therefore \quad D_s = D_{se} + D_{si} = 2 + 2 = 4$

26. (a)

Method-1:

$D_S = 3m + r_e - r_r - 3(j + j')$

Number of members m = 10

Number of external reactions $r_e = 12$

Number of internal reaction components released $(r_r) = 2$

Number of rigid joints $(j) = 8$

Number of joints at which releases are located $(j') = 2$

$\therefore \quad D_S = 3 \times 10 + 12 - 2 - 3 \times (8 + 2) = 10$

Method-2:

D_s = (3 × no. of cuts) – no. of reactions added to make stable cantilever

$= (3 \times 4) - 1 - 1 = 10$

27. (0)

Number of member,

$m = 4$

Number of external reaction,

$r_e = 4$

Number of joint,

$j = 5$

Number of reaction released,

$r_r = 1$

Degree of static indeterminacy,

$D_s = 3m + r_e - 3j - r_r$

$= 3 \times 4 + 4 - 3 \times 5 - 1 = 0$

28. (a)

Frame is externally determinate but internally indeterminate to first degree.

External indeterminacy

$= r_e - 3 = 3 - 3 = 0$

Internal indeterminacy

$= m - (2j - 3) = 6 - (8 - 3) = 1$

Alternate Solution :

Degree of static indeterminacy,

$D_s = m + r - 2j$

$= 6 + 3 - (2 \times 4) = 1$

29. (c)

Method-1:

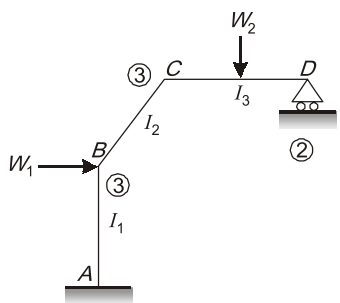
For rigid jointed plane frame, the degree of kinematic indeterminacy without neglecting axial deformations $D_k = 3j - r_e$. If axial deformations are neglected then

$D_K = 3j - r_e - m.$

$j = 4;\ m = 3;\ r_e = 3 + 1 = 4$

$\therefore \quad D_K = 3 \times 4 - 4 - 3 = 5$

Method-2:



D_k (in extensble) = D_k (extensible) – no. of axially rigid members

$= (3j - r_e) - m$

$= 3 \times 4 - 4 - 3 = 5$

DESIGN OF STEEL STRUCTURES

OBJECTIVE PRACTICE SETS

Page No. 168 - 262

1 CHAPTER

Introduction

Q.1 **Statement (I):** Steel is particularly useful for carrying heavy loads with relatively small sections as compared to other structural materials.
Statement (II) : As compared to other structural materials, steel has high strength to weight ratio.
(a) Both Statement (I) and Statement (II) are individually true; and Statement (II) is the correct explanation of Statement (I)
(b) Both Statement (I) and Statement (II) are individually true; but Statement (II) is NOT the correct explanation of Statement (I)
(c) Statement (I) is true; but Statement (II) is false
(d) Statement (I) is false; but Statement (II) is true

Q.2 For steel in contact with water and soil and those subjected to alternate wetting and drying, how much additional thickness should be provided in steel sections?
(a) 1 mm (b) 1.5 mm
(c) 2 mm (d) 2.5 mm

Q.3 Which of the following statement is true for compact sections?
(a) The stress distribution for such sections is triangular.
(b) These can develop plastic hinges and have rotation capacity required for failure of structure by formation of plastic hinges.
(c) These can develop plastic moment of resistance, but have inadequate plastic hinge rotation capacity for formation of a plastic mechanism before buckling.
(d) None of the above

Q.4 Which code is used to calculate earthquake load on structure?
(a) IS 875 Part IV (b) IS 875 Part III
(c) IS 1839 (d) IS 1893

Q.5 Which of the following methods of design would be suitable for metal structures subjected to stress reversals and impact?
1. Simple working stress design
2. Rigid-plastic design
3. Semirigid design
4. Elastic rigid design

Select the correct answer using the codes given below:
(a) 1, 2 and 4 (b) 1, 3 and 4
(c) 1, 2 and 3 (d) 2, 3 and 4

Q.6 Consider the following statements:
Aluminum is being increasingly used for structural purposes because
1. its modulus of elasticity is double that of steel
2. its coefficient of thermal expansion is half that of steel
3. it requires less maintenance
4. the strength to unit weight ratio of aluminum is high

Which of these statements are correct?
(a) 1 and 4 (b) 2 and 4
(c) 1, 2 and 3 (d) 3 and 4

Q.7 In the context of the ultimate load theory for steel, the stress-strain curve for steel is idealized as
(a) a single straight line
(b) bilinear
(c) a quadratic parabola
(d) a circular arc

Q.8 Unit mass of steel and modulus of elasticity (as per IS 800 : 2007)
(a) 7850 kg/m^3, 2×10^5 N/mm^2
(b) 7850 kg/m^3, 2.1×10^6 N/mm^2
(c) 7500 kg/m^3, 2×10^5 N/mm^2
(d) 7850 kg/m^3, 2.1×10^5 N/mm^2

Q.9 As per IS : 875, for the purpose of specifying basic wind velocity, the country has been divided into
(a) 4 zones (b) 5 zones
(c) 6 zones (d) 7 zones

Answers Introduction

1. (a) 2. (b) 3. (c) 4. (d) 5. (b) 6. (d) 7. (b) 8. (a) 9. (c)

Explanations Introduction

1. (a)
As compared to other structural materials, steel has high strength to weight ratio. It implies, steel possess very high strength and results in smaller sections as compared to other structural materials. Thus steel is particularly useful for carrying heavy loads with relatively small sections.

2. (b)
An additional thickness of 1.5 mm should be provided in steel which is in content with soil and water and is subjected to alternate welting and drying.

3. (c)
Stress distribution of compact sections is rectangular.

4. (d)
IS 1893 is used for earthquake load stadia an a structure.
IS 875 part *I* to *V* are used to calculate dead load, live load, wind load, snow load, and various possible load combinations respectively and IS 1893 is used for for earthquake load.

5. (b)
Working stress design, elastic rigid design, semirigid design are suitable design methods for metal structures subjected to stress reversals and impact.

6. (d)
Aluminium in increasingly used because it require less maintenance and its strength to unit weight ratio of alluminum is high.

9. (c)
6 basic winds speeds considered for zoning are:
55 m/sec (198 km/h) Very high damage risk zone-A
50 m/sec (180 km/h) Very high damage risk zone-B
47 m/sec (169.2 km/h) High damage risk zone-C
44 m/sec (158.4 km/h) Moderate damage risk zone-A
39 m/sec (140.4 km/h) Moderate damage risk zone-B
33 m/sec (118.8 km/h) Low damage risk zone

■■■■